

other life in the solar system. "The first microbial ecosystems on Earth probably occurred in the sub-seafloor associated with hydrothermal venting," Baross says. "A number of planets underwent parallel evolution [physically and hydrologically] . . . so similar life may have arisen on Mars, Venus, or a number of moons."

Free Radicals and Breast Cancer

The metastasis of breast cancer may be the result, at least in part, of damage to tumor-suppressing genes or activation of oncogenes by the hydroxyl free radical, according to results of a study by scientists at the Pacific Northwest Research Foundation in Seattle.

A free radical is a molecule with an unpaired electron. The hydroxyl radical (-OH) results from the metabolism of hydrogen peroxide (H_2O_2), probably a by-product of the cycling of estrogen. Normally, the free radical is countered by the cells' antioxidant systems without damage to the cellular DNA. As a woman ages, however, cellular protection may become less effective and DNA damage is wrought faster than the free radicals can be controlled and damage repaired. This process also can be hastened by exposure to radiation, carcinogenic chemicals, and high-fat, high-calorie diets.

Building upon their previous finding of significantly higher amounts of DNA damage in women with breast cancer than in healthy women, Donald C. Malins, director of the Molecular Epidemiology Program at the foundation, and colleagues began to assess what they termed radical-induced DNA disorder (RIDD).

Malins obtained 12 cancer tissue specimens from women with breast cancer who had no nodal evidence of metastasis; 25 specimens from women with metastatic cancer; and 21 specimens of breast tissue from healthy women who had undergone breast reduction surgery. DNA was isolated from each specimen and analyzed by Fourier transform infrared spectroscopy and gas chromatography to determine the extent of DNA damage. Results, reported in the March 19 issue of the *Proceedings of the National Academy of Sciences*, showed that the DNA from the metastatic tissue had more than twice the damage of the DNA from the nonmetastatic tissue, and also had a greater diversity in the base DNA structure.

"It appears that free radicals play a major role in causing genetic changes linked to cancer and metastasis," Malins says. "RIDD may form the basis of a test to determine a woman's risk of metastatic cancer and perhaps enable some intervention to prevent it."

Once the cancer has formed, Malins

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Seafood and Health

Satisfying the world's appetite for seafood requires that 89 tons of fish be harvested every year. Though many think of seafood as a healthy alternative to meat, aquatic pollutants and epidemics in some fish-producing countries are threatening the quality and safety of much of the world's seafood supply. In an attempt to ensure that the seafood Americans eat is free from toxic chemicals and pathogens, the FDA has developed new regulations, including the Hazard Analysis and Critical Control Point (HACCP) program, to govern seafood production and distribution.

New health threats and regulations can become confusing for both consumers and people in the fishing industry. To help simplify matters, Robert J. Price of the University of California-Davis has developed the Seafood Network Information Center, or SeafoodNIC, on the Internet. The site, located at <http://www-seafood.ucdavis.edu>, contains a coherent abundance of information concerning fish, potential health risks associated with consuming fish, and relevant regulations. From the home page, users can access information on upcoming seafood symposia and meetings around the world, detailed information about HACCP (though this section is largely unfinished), texts of various FDA regulations, a collection of papers on seafood safety and quality, and a long list of links to other seafood-related sites.

The Guidelines and Regulations link connects users to the bulk of the health-related information available at the site. This section contains descriptions of new rules proposed by the FDA as well as the text of current regulations. Some of the posted regulations are also provided in a format that can be downloaded to a word processing program. Under the Model Forms, Guides, and Lists heading of the 1993 FDA Food Code, a page is maintained that lists fish-producing regions of the world with data on what diseases are epidemic or endemic in those areas according to the World Health Organization and the Centers for Disease Control and Prevention. The list reflects the growing concern that human pathogens like *Salmonella typhi* and the hepatitis A virus can be transmitted worldwide through exported food products. The 1994 FDA Hazards and Control Guides section includes a list of popular commercial fish species along with the health hazards commonly associated with each of them. A similar list is provided for health hazards associated with particular steps in seafood processing. Both lists take into account chemical pollutants present in fish as well as microbial contamination. In a separate section, an explanation of each contaminant is provided along with information on how to protect fish products from it; pathogens, mercury, natural toxins, decomposition, histamines, food additives, aquaculture drugs, parasites, and chemical contamination hazards are all covered in this section.

Under the heading Links and Information Services, users can access additional information from related sites. The extensive list of linked sites includes fishing industry associations, agencies of the federal government, marine sciences libraries, professional societies, seafood industries, Sea Grant programs, and university food science programs.

To keep even closer tabs on developments in the areas of fish and human health, users can join the SeafoodNIC newsgroup via e-mail by following the instructions provided under the heading Seafood Listserv.

pointed out, it begins to produce its own H_2O_2 , leading to reduced cell adhesion within the tumor, allowing cells to be shed and to migrate and colonize elsewhere, and producing higher levels of -OH . "Getting an antioxidant into the tissue to reduce the hydroxyl level could be instrumental in controlling the cancer," he said.

Some scientists have questioned the methodologies used by Malins and note that studies published in the February 1996 issue of *Carcinogenesis* and the December 1995 issue of *Chemical Research in Toxicology*

failed to duplicate Malins' initial results using identical methods.

However, "this is a logical step forward in determining the role of free radicals in carcinogenesis and metastasis," said John A. Strupp, director of oncology and hematology at St. Thomas Hospital and clinical professor of oncology at Vanderbilt University School of Medicine in Nashville. "Whether intervention with antioxidants such as vitamins A, E, and C can reduce free-radical production and cancer metastasis remains to be seen."

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